

REMARKS

Applicant has indicated in the previous amendment dated August 27, 2002, that the rejection of claims 8-10, 13 and 14 under the judicially created doctrine of obviousness-type double patenting over claims 12-17 of U.S. Patent 5,730,932 to Sarkhel, et al would be responded to by the filing of a Terminal Disclaimer upon receipt of an indication of allowable subject matter. The Examiner has indicated that a Terminal Disclaimer would be acceptable for overcoming this rejection. To date, applicant has not yet received from the Examiner any indication of the allowability of any of the claims. Accordingly, applicant reserves the right to file a Terminal Disclaimer should it be necessary to appeal this final rejection in order to remove this rejection from the appealed claims.

The rejection of claims 8-9 and 13-14 under 35 USC 103 as being unpatentable over U.S. Patent 5,439,639 to Vianco in view of U.S. Patent Re. 33197 to Deambrosio, U.S. Patent Re. 32982 to O'Rourke or U.S. Patent 5,361,969 to Gileta is respectfully traversed.

Claim 9 was originally dependent upon claim 8 which has now been converted into an independent claim combining all of the limitations of original claim 8 with that of claim 9. Claim 10 has now been made dependent upon claim 9. The Examiner has not made any distinction in the final rejection between claims 8 and 9 and accordingly, the amendment to claim 9 as an independent claim should be entered for purposes of appeal should this become necessary. The method of claim 9 is now limited to the joining of at least two microelectronic components to one another by connecting the components with a ternary solder alloy consisting essentially of from about 70 to less than 91 wt % tin, between 6 to about 15 wt % bismuth and 2 to 5 wt % silver. The use of this composition is clearly supported on page 15 of the specification and represents the marked region consisting of the shaded rectangle JKLM in Figure 5 with tin limited to the range of from about 70% to less than 91% and with the content of bismuth exceeding 5% and being preferably above 6% to about 15 wt %. Applicant has already explained

on several prior occasions why alloys containing less than 5 wt % bismuth are unacceptable. This is also taught on page 12 of the specification, second paragraph, wherein it is stated, referring to the ternary triangle, that alloys having essentially from 0% to under 5% bismuth will not result in a sufficient lowering of the melting point below 221C which is the melting point of the binary 96.5Sn/3.5Ag/0.0Bi alloy. In accordance with the present invention, lowering of the melting point would be defeated if bismuth were below 5 wt %.

The Examiner has repeatedly rejected claims 8 and 9 citing the Vianco reference U.S. Patent 5,439,639 as the primary reference. However, Vianco clearly teaches away from the use of bismuth above 5 wt %. Vianco includes in table 1 an alloy containing 6.23Bi, which is the last alloy in the table, but clearly discards this composition as undesirable. This is explained in the paragraph directly below table 1 as well as in column 4, lines 41-50 and in column 7, lines 20-24. Despite this clear teaching away from the use of above 5 wt % bismuth, the Examiner responds by stating that the last alloy of table 1 in Vianco anticipates the claimed solder composition of the subject invention and should be considered simply as a less preferred embodiment. Upon what does the Examiner base this conclusion which contradicts Vianco. In Vianco, the objective of the bismuth is to form a solid solution with tin and not to allow bismuth (Bi) to precipitate as crystals (or, as a phase). In fact, Vianco does not teach nor permit the alloy compositions which contain bismuth to precipitate out of solid solution, see column 4, lines 41 through 50. Vianco specifically states that as long as there is less than 5 wt % bismuth, the tin-bismuth eutectic (139°C) phase would not be expected to form. It is only when bismuth is below 5 wt % that the desired property of a finite solid solubility with tin is feasible.

In the method of the present invention, the objective is for the alloy to cause a lowering of the melting point to closer to that of the melting point of the binary 96.5Sn/3.5Ag/0.0Bi alloy. In accordance with the teaching of the present invention, this can only be achieved when bismuth is above 5 wt % and preferably at least 6 wt % as

claimed in claim 9. Accordingly, the objective of the present invention is inconsistent with the objective of Vianco at least as far as the teaching of bismuth is concerned. In fact, the objective of the present invention is to allow bismuth crystals to precipitate and to be part of the solidified micro structure directly contrary to the teaching of Vianco. This occurs only when bismuth is in excess of 5 wt %. Accordingly, the teaching of the two references are completely opposite to one another with regard to the content of bismuth and the objective relative thereto. For the Examiner to disregard this and to point to the last alloy in table 1 of Vianco as being anticipatory of the subject invention flies in the face of the requirements of 35 USC 103. The Examiner's reference to what is well settled law is correct but misplaced and non-applicable when it comes to the subject of a reference which "teaches away" from the invention. To the contrary, this area of the law is clear and as was stated in *In Re Gurley*, 31 USPQ 2d 1130, 1132 (Fed. Cir. 1994) where it is stated:

"....A reference may be said to teach away when a person of ordinary skill, upon reading the reference, will be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicants. See *United States v. Adams*, 383 U.S. 39, 52, 148 USPQ 479, 484 (1966) ("Known disadvantages in old devices which would naturally discourage the search for new inventions may be taken into account in determining obviousness"); *W.L. Gore and Associates, Inc. v. Garlock, Inc.*, 721 F. 2d. 1540, 1550-1551, 220 USPQ 303, 311 (Fed. Cir. 1983) ("The totality of a reference's teachings must be considered", cert. denied, 469 U.S. 841 (1984); *In re Sponnoble*, 405 F. 2d 578, 587, 160 USPQ 237, 244 (CCPA 1969) "References taken in combination teach away since they would produce a ("seemingly inoperative device"); *In re Caldwell*, 319 F. 2d 254, 256, 138 USPQ 243, 245 (CCPA

1963) ("References teach away if it leaves the impression that the product would not have the properties sought by the applicant")....."

It is well established law that an invention that might otherwise be viewed as an obvious modification of the prior art will not be deemed obvious under 35 USC 103 in connection with prior art references which teach away from the invention. See *Gillette Company v. Johnson & Sons, Inc.*, 16 USPQ 2d. 1923 (Fed. Cir. 1990) where it states that the closest prior art reference "would likely discourage the art worker from attempting the substitution suggested". This is clearly the situation in the present case where one reading Vianco is clearly led away from the use of a ternary composition containing bismuth above 5 wt % much less at above 6 wt %. Accordingly, Vianco does not teach the use of a ternary composition for joining microelectronic components containing at least about 6 wt % bismuth. Moreover, the range for tin is not taught in Vianco. Accordingly, claims 9 and 10 as amended are clearly patentable over Vianco. The remaining references cited by the Examiner inclusive of Deambrosio, O'Rourke and Gileta do not teach the use of the ternary composition taught by applicant. As regards claims 13 and 14, the Examiner acknowledges that Vianco does not teach the wave soldering set up of claim 13. Since Vianco clearly teaches away from the use of the ternary composition as taught by applicant, substituting a wave soldering set up from the same field of endeavor in an analogous art does not satisfy the requirements of 35 USC 103 to render the claims unpatentable.

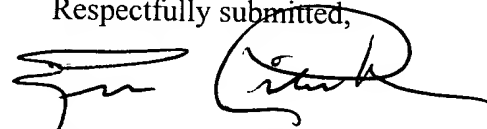
The rejection of claim 10 under 35 USC 103 as being unpatentable when applied to all the references used in the rejection of claims 8-9 and 13-14 when further considered in view of Kattner, et al is respectfully traversed.

Claim 10 is a dependent claim which depends from claim 9 as amended and is clearly considered patentable over Vianco for all of the above reasons. Furthermore, the reference of the Examiner to column 2, lines 38-51 in Vianco with regard to bismuth relates to yet another patent reference, namely Tucker, et al (U.S. Patent 4,929,423)

which the Examiner has not made of record and which is irrelevant to the subject invention. Moreover, Vianco specifically states in column 2, lines 65-68 that the alloys of Tucker, et al which relate to the solder composition referred to by the Examiner, would require extensive modification to be acceptable as solder compositions for an electronic assembly and, as such, is not relevant to the subject of the present application.

For all of the above reasons, claims 9-10 and 13-14 are clearly patentable over the references of record, taken individually or in combination. Reconsideration and allowance of claims 9-10 and 13-14 is respectfully solicited.

Respectfully submitted,

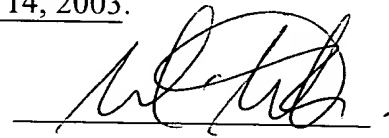


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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed: Commissioner of Patents & Trademarks, Washington, DC 20231 on March 14, 2003.



Date: March 14, 2003

AMENDMENTS TO THE CLAIMS

9. (Amended) A method [as defined in claim 8 wherein said solder alloy consists essentially of] of joining at least two microelectronic components to one another comprising the steps of connecting the components to be joined with a ternary solder alloy consisting essentially of from about 70 to less than 91 wt percent tin, between 6 to about to about 15 wt % bismuth and 2 to 5 wt % silver.

10. (Amended) A method as defined in claim [8] 9 wherein said solder alloy consists essentially of about 10-15 wt % bismuth, 3.3-3.5 wt % silver, balance tin.

13. (Amended) A process for producing circuit boards, comprising the steps of:

producing plated through holes in a circuit board;

inserting the pins of pin-in-hole components into the plated through holes;

producing a stationary wave of liquid solder consisting essentially of [a major proportion of tin,] from about 70 to less than 91 wt % tin, between 6 to about 15 wt% bismuth and from 2 to 5 wt% silver;

moving the circuit board across the wave with the bottom of the circuit board in contact with the wave, thereby substantially filling the plated through holes with solder;

cooling the circuit board to form solid solder joints.

14. (Amended) A process for producing circuit boards comprising the steps of:

producing a substrate with multiple wiring layers including exposed metal pads on a surface;

forming a solder paste comprising a flux, an organic vehicle and particles of metal consisting essentially of [a major proportion of tin,] from about 70 to less than 91 wt % tin, bismuth in excess of 6 wt% and up to about 15 wt% and from 2 to 5 wt% silver;

depositing the solder past upon said substrate;

placing terminals of a surface mount component onto corresponding pads of the substrate;

heating said solder paste to a temperature above the liquidous temperature of the solder paste sufficient to reflow the solder paste to connect the substrate; and

cooling to solidify the connections.